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**Gorst Creek - Bremerton Auto Wrecking  
Landfill  
Preliminary Assessment Report  
Port Orchard, Washington  
TDD: 02-10-0005**

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Contract: 68-S0-01-01  
May 2003

Region 10  
***START-2***

Superfund Technical Assessment and Response Team

Submitted To: Joanne LaBaw, Task Monitor  
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USEPA SF



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**GORST CREEK - BREMERTON AUTO WRECKING LANDFILL  
PRELIMINARY ASSESSMENT REPORT  
PORT ORCHARD, WASHINGTON**

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## LIST OF ACRONYMS

<u>Acronym</u>	<u>Definition</u>
$\mu\text{g/L}$	micrograms per liter
E & E	Ecology and Environment, Inc.
EPA	United States Environmental Protection Agency
PA	Preliminary Assessment
PCBs	polychlorinated biphenyls
PPE	Probable point of entry
PSNS	Puget Sound Naval Shipyard
START	Superfund Technical Assessment and Response Team
SVOCs	semivolatile organic compounds
TCLP	toxicity characteristic leaching procedure
TDL	Target Distance Limit
TPHD	total petroleum hydrocarbons as diesel
TPHG	total petroleum hydrocarbons as gasoline
VOCs	volatile organic compounds

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intentionally left blank.**

**GORST CREEK - BREMERTON AUTO WRECKING LANDFILL  
PRELIMINARY ASSESSMENT REPORT  
PORT ORCHARD, WASHINGTON**

**1. INTRODUCTION**

Ecology and Environment, Inc., (E & E) was tasked by the United States Environmental Protection Agency (EPA) to provide technical support for completion of a Preliminary Assessment (PA) at the Gorst Creek - Bremerton Auto Wrecking Landfill site in Port Orchard, Washington. E & E completed PA activities under Technical Direction Document No. 02-10-0005, issued under EPA, Region 10, Superfund Technical Assessment and Response Team (START)-2 Contract No. 68-S0-01-01.

The specific goals for the Gorst Creek - Bremerton Auto Wrecking Landfill PA, identified by the EPA, are:

- Determine the potential threat to public health or the environment posed by the site;
- Determine the potential for a release of hazardous constituents into the environment; and
- Determine the potential for placement of the site on the National Priorities List.

Completion of the PA included reviewing existing site information, collecting receptor information within the range of site influence, determining regional characteristics, and conducting a site visit. This document includes a discussion of background site information (Section 2), a discussion of migration/exposure pathways and potential receptors (targets; Section 3), conclusions and recommendations (Section 4), and a list of pertinent references (Section 5).

## **2. SITE BACKGROUND**

### **2.1 SITE LOCATION**

Site Name: Gorst Creek - Bremerton Auto Wrecking Landfill  
CERCLIS ID No.: WAN001002414  
Location: 4275 State Route 3 SW  
Port Orchard, Washington 98367  
Latitude: 47° 30' 36.40" N  
Longitude: 122° 44' 29.4" W  
Legal Description: Township 23N, Range 1W, Section 1  
Congressional District: Washington  
County: Kitsap  
Site Owner(s): Carina Trust  
% Bill Nilles  
12117 196<sup>th</sup> Avenue KPN  
Gig Harbor, Washington 98329  
253-884-1509  
  
Site Contact(s): Bill Nilles  
12117 196<sup>th</sup> Avenue KPN  
Gig Harbor, Washington 98329  
253-884-1509  
  
Grant Holdcroft  
Kitsap County Health Department  
19540 Front Street  
P.O. Box 1076  
Poulsbo, Washington 98370  
360-337-5607

### **2.2 SITE DESCRIPTION/OWNERSHIP HISTORY**

The Gorst Creek - Bremerton Auto Wrecking Landfill is located in the NW ¼ of the SW ¼ of Section 1, Township 23N, Range 1W in Kitsap County, Washington, and approximately 1.5 miles west of Gorst, Washington along the southeast side of State Highway 3 SW (Figure 2-1; EPA 2003). The site is located approximately 5 miles southwest of Port Orchard and approximately 6 miles south-southwest



of Bremerton. Gorst Creek - Bremerton Auto Wrecking Landfill is identified by the Kitsap County Tax Assessor as parcel 012301-4-022-1005. The Gorst Creek - Bremerton Auto Wrecking Landfill is a triangular parcel centered over approximately 700 feet of the Gorst Creek ravine (Figure 2-2). Gorst Creek is a stream flowing through the ravine that originally ranged between 60 and 80 feet deep over the length of the subject property. Since the creek has been filled the depth of the creek under the landfill is unknown. The creek ravine was first used as a landfill site in 1968, at which time a concrete culvert was constructed to carry creek water through and under the landfill (Hart Crowser 2000). Vehicle access to the site can only be obtained from the northeast through the adjacent auto wrecking yard (Airport Auto Wrecking, Too). The Washington State Department of Transportation owns the property directly north and west of the landfill. This property contains State Highway 3 SW and an easement corridor on either side of the highway (Figure 2-2).

The Gorst Creek - Bremerton Auto Wrecking Landfill was active from 1968 until the late 1980s. Historical records indicate three distinct generations of operation and ownership at the site. The auto wrecking yard operation was started by three Bremerton-area businessmen in 1964 as Ames Auto Wrecking, Inc. The landfill operation, under the same name, began in April 1968 when the property owners began accepting public waste for disposal in the Gorst Creek ravine. Soon after, Ames Auto Wrecking, Inc. successfully underbid a competing disposal site for the Puget Sound Naval Shipyard (PSNS) refuse disposal contract for the period of July 1, 1969, through June 30, 1970. After the one-year PSNS contract expired, the Ames landfill continued to acquire contracts to accept waste from public dumping and occasional demolition debris. (Hart Crowser 2000)

The second generation of the landfill operations began in 1973, when a new owner took over and renamed the site Bremerton Auto Wrecking, Inc. The second owner (whose identity could not be determined) continued the public and demolition debris landfill operation until 1980, when the property was sold to Mr. Sid Uhnick of Bremerton, Washington. After 1980, the landfill was permitted only for demolition debris, but continued to accept public waste, which was in violation of its permit. The landfill was permitted as a demolition disposal site from 1985 through 1989. Mr. Uhnick passed away in 1985 and left the property and operations to his wife Mrs. Lucille Uhnick. In 1989, a "Declaration of Property Line Adjustment" was filed in Kitsap County, Washington to separate the land containing the landfill property from the adjacent auto wrecking yard. The site is now separated as two parcels (Hart Crowser 2000). While the name of the site implies that both parcels are being investigated, this PA report is only concerned the former landfill portion of the properties.

The landfill portion of the property was purchased by the current owner, Mr. Bill Nilles, in March 2002 (Holdcroft 2003a).

### **2.3 SITE OPERATIONS AND WASTE CHARACTERISTICS**

The Gorst Creek - Bremerton Auto Wrecking Landfill was active from 1968 until the late 1980s. The site has historically been associated with auto wrecking wastes but additional information about the site indicate the Gorst Creek - Bremerton Auto Wrecking Landfill received other wastes such as medical waste from PSNS, during the one-year contract that expired in 1970 as well as demolition debris and public waste. The creek ravine was first used as a landfill site in 1968, at which time a concrete culvert was constructed to carry creek water through and under the landfill. (Hart Crowser 2000)

On March 19, 1997 after a significant rainfall event (7.3 inches in 24 hours), Gorst Creek backed up behind the landfill, and flooded (Hart Crowser 2000). The water ran over the top of the landfill. A portion of the northwest slope of the landfill failed, washing into Gorst Creek downslope of the landfill. Wastes were found approximately ½ mile downstream in Gorst Creek (Holdcroft 2003b). After this slope failure, two rip rap catchment berms with corrugated metal 24 inch culverts were installed on Gorst Creek in an attempt to stop future possible slope failures from washing landfill debris downstream. In January 2002, after another heavy rainfall event, Gorst Creek backed up and flooded over the landfill resulting in slope failure (Holdcroft 2003b). This slope failure was smaller than the 1997 failure; however, again landfill debris was released into Gorst Creek. The most upstream rip rap catchment berm was destroyed during the flood. The lower catchment berm remained in place and is still present today (Appendix A; Photographs 1-19 and 1-20; Hart Crowser 2000; Holdcroft 2003b).

Currently, the Gorst Creek - Bremerton Auto Wrecking Landfill is covered with blackberry brambles (Appendix A; photographs 1-7 through 1-14). Based on the findings of the Site Hazard Assessment conducted by Hart Crowser in 2000, the contaminants of concern at the site include pesticides/polychlorinated biphenyls (pesticides/PCBs), semivolatile organic compounds (SVOCs), Target Analyte List metals, and volatile organic compounds (VOCs). The site is estimated to contain approximately 150,000 cubic yards of waste (Hart Crowser 2000).

In 1999 and 2000 Hart Crowser conducted a Site Hazard Assessment of the Gorst Creek - Bremerton Auto Wrecking Landfill for the PSNS. During the study, Hart Crowser conducted a property boundary and elevation survey, a limited landfill soil and slope stability assessment, and a characterization of the area hydrogeology. As part of this study, Hart Crowser also conducted surface soil, sediment, groundwater, and surface water sampling.

Based on the reconnaissance information collected by geotechnical engineers, Hart Crowser noted the following conditions. There was evidence of debris flows and surface erosion near the northwest limits of the landfill waste. In this area, the underlying native soil material contains oversteepened slopes that are particularly susceptible to surface erosion and "blowouts". The natural slopes along the sides of the ravine are estimated to be about 36 degrees to 40 degrees from horizontal. In general, the native ravine slopes appear to contain evidence of deep-seated sliding or slumps. Debris flows are primarily attributed to surface water erosion and groundwater seepage. If the buried culvert pipe running beneath the landfill mass is broken or truncated, this would further contribute to the instability of the landfill. (Hart Crowser 2000)

During the environmental investigation portion of the Site Hazard Assessment, Hart Crowser collected surface soil, sediment, groundwater, and surface water samples. The surface soil samples were analyzed for total petroleum hydrocarbons as gasoline (TPHG), total petroleum hydrocarbons as diesel (TPHD), pesticides/PCBs, priority pollutant metals, leachable property pollutant metals by toxicity characteristic leaching procedure (TCLP), VOCs, and SVOCs. Four discrete surface soil samples, including one background sample, were collected (Figure 2-3). In addition, three composite surface soil samples were collected (Figure 2-3). Table 2-1 presents the analytes which were detected above the instrument detection limit. (Hart Crowser 2000)

Sediment samples were analyzed for TPHG, TPHD, pesticides/PCBs, priority pollutant metals, TCLP priority pollutant metals, SVOCs, VOCs, and total organic carbon. Four sediment samples, including one background and three composite samples from Gorst Creek downstream of the landfill (Figure 2-3). Table 2-2 presents the analytes which were detected above the instrument detection limit. (Hart Crowser 2000)

Groundwater samples were analyzed for PCBs, total and dissolved priority pollutant metals, VOCs, SVOCs, and total suspended solids. One groundwater sample from monitoring well BR-11, which is located on Gorst Creek approximately 0.15 mile from the site. No analytes were detected above the instrument detection limit. (Hart Crowser 2000)

Surface water samples were analyzed for PCBs, total and dissolved priority pollutants metals, VOCs, SVOCs, total suspended solids, hardness, cations, and anions. Two surface water samples, one upstream and one downstream of the landfill (Figure 2-3). Only mercury was detected in the sample at the upstream sample location. No analytes were detected in the sample from the downstream location. (Hart Crowser 2000)

## **2.4 START-2 ACTIONS**

The START-2 conducted a site visit on January 28, 2003. Photographic documentation of the site visit is provided in Appendix A. Accompanying the START-2 on the site visit were Joanne LaBaw (EPA Task Monitor), Grant Holdcroft (Kitsap County Health Department), Mr. Bill Nilles (the property owner), and Jeff Ryan (property owner's consultant). The site consists of a triangular shaped property which is covered with blackberry brambles. Gorst Creek flows northwest under the property through a pipe. At the time of the site visit, Gorst Creek was backed up on the southeast side of the property. The back up behind the landfill was estimated by Grant Holdcroft to be approximately 30 feet deep by 400 feet long by approximately 30 feet deep based upon his numerous previous visits under dry conditions (Holdcroft 2003b). Debris was floating in the impoundment (Appendix A; Photographs 1-1,1-2, 1-15, and 1-16). The backup occurs after substantial rainfall and during dry periods does not exist (Holdcroft 2003b). Under normal conditions, the slope of the land at the southeast edge of the property is approximately 45 degrees and the debris currently seen floating on the landfill is visible on the slopes (Holdcroft 2003b).

Table 2-1

**SURFACE SOIL SAMPLES ANALYTICAL RESULTS SUMMARY**  
**GORST CREEK - BREMERTON AUTO WRECKING LANDFILL PRELIMINARY ASSESSMENT**  
**PORT ORCHARD, WASHINGTON**

Sample ID	GL-SS-01	GL-SS-02	GL-SS-03	GL-SS-04	GL-SS-05	GL-SS-06	GL-SS-07	GL-SS-08
Sample Date	1/10/2000	1/10/2000	1/10/2000	1/10/2000	1/10/2000	1/10/2000	1/10/2000	1/10/2000
Description	Background	Discrete Grab			Composite			Field Duplicate
Pesticides/PCBs (mg/kg)								
Aroclor 1248	0.044 U	0.039 U	0.23	0.44	0.036 U	0.04 U	0.04 U	0.04 U
Aroclor 1254	0.044 U	0.039 U	0.039 U	0.038 U	0.14	0.04 U	0.04 U	0.04 U
Aroclor 1260	0.044 U	0.042	0.14	0.12	0.036 U	0.04 U	0.04 U	0.04 U
Total PCBs	0.044 U	0.042	0.37	0.56	0.14	0.04 U	0.04 U	0.04 U
4,4'-DDD	0.0044 U	0.004 U	0.004 U	0.037 J	0.0036 U	0.004 U	0.004 U	0.004 U
4,4'-DDE	0.0044 U	0.004 U	0.016 J	0.026 J	0.03 J	0.004 U	0.004 U	0.004 U
4,4'-DDT	0.0044 U	0.015 J	0.03 J	0.04 J	0.058	0.004 U	0.004 U	0.004 U
Alpha-Chlordane	0.0022 U	0.011 J	0.002 U	0.0019 U	0.0018 U	0.002 U	0.002 U	0.002 U
Dieldrin	0.0044 U	0.004 U	0.017	0.029 J	0.038 J	0.004 U	0.004 U	0.004 U
Endosulfan I	0.0022 U	0.002 U	0.002 U	0.0019 U	0.01 J	0.002 U	0.002 U	0.002 U
Endosulfan II	0.0044 U	0.004 U	0.004 U	0.0038 U	0.0095 J	0.004 U	0.004 U	0.004 U
Endosulfan Sulfate	0.0044 U	0.009	0.004 U	0.0038 U	0.0036 U	0.004 U	0.004 U	0.004 U
Endrin	0.0044 U	0.004 U	0.004 U	0.0038 U	0.0077 J	0.004 U	0.004 U	0.004 U
Endrin Ketone	0.0044 U	0.004 U	0.005	0.0038 U	0.0036 U	0.004 U	0.004 U	0.004 U
Gamma-Chlordane	0.0022 U	0.008	0.009 J	0.015 J	0.02 J	0.002 U	0.002 U	0.002 U
Heptachlor Epoxide	0.0022 U	0.002 U	0.007 J	0.0019 U	0.0087 J	0.002 U	0.002 U	0.002 U
SVOCs (mg/kg)								
2-Methylnaphthalene	0.44 U	0.013 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Acenaphthene	0.44 U	0.026 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Acenaphthylene	0.44 U	0.014 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Anthracene	0.44 U	0.067 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Benzo(a)anthracene	0.44 U	0.15 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Benzo(a)pyrene	0.44 U	0.14 J	0.016 J	0.37 U	0.015 J	0.4 U	0.4 U	0.4 U
Benzo(b)fluoranthene	0.44 U	0.12	0.009 J	0.006 J	0.36 U	0.4 U	0.4	0.4 U
Benzo(g,h,i)perylene	0.44 U	0.096 J	0.011 J	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Benzo(k)fluoranthene	0.44 U	0.1	0.005 J	0.003 J	0.36 U	0.4 U	0.4	0.4 U
Butylbenzylphthalate	0.016 J	0.15 J	0.048 J	0.031 J	0.024 J	0.009 J	0.4 U	0.009 J
Carbazole	0.44 U	0.034 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Chrysene	0.44 U	0.18 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Dibenz(a,h)anthracene	0.44 U	0.03 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Dibenzofuran	0.44 U	0.013 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Dimethylphthalate	0.44 U	0.089 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Di-n-butylphthalate	0.44 U	0.39 U	0.39 U	0.028 J	0.36 U	0.4 U	0.4 U	0.4 U
Fluoranthene	0.44 U	0.28 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Fluorene	0.44 U	0.032 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Indeno(1,2,3-cd)pyrene	0.44 U	0.088J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Naphthalene	0.44 U	0.032 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Phenanthrene	0.44 U	0.28 J	0.39 U	0.37 U	0.36 U	0.4 U	0.4 U	0.4 U
Pyrene	0.44 U	0.29 J	0.009 J	0.009 J	0.36 U	0.4 U	0.4 U	0.4 U

## PHOTOGRAPH IDENTIFICATION SHEET

Camera Serial No.: 897924

TDD No: 02-10-0005

Lens Type: Pentax Zoom 90-WR 35 mm

Site Name: Gorst Creek - Bremerton Auto Wrecking Landfill

Photo No.	Dir.	Date	Time	By	Description
1-1	W	01/28/03	1347	ML	Pond upstream side of landfill. Pond resulting from rainfall impounded in ravine, estimated 30 feet deep in center.
1-2	SW	01/28/03	1419	ML	Pond upstream side of landfill.
1-3	S	01/28/03	1429	ML	Panorama of landfill area taken from Airport Auto Wrecking Too. The landfill is the brush covered area.
1-4	SW	01/28/03	1429	ML	Panorama of landfill area taken from Airport Auto Wrecking, Too. The landfill is the brush covered area.
1-5	SW	01/28/03	1429	ML	Panorama of landfill area taken from Airport Auto Wrecking, Too. The landfill is the brush covered area.
1-6	W	01/28/03	1429	ML	Panorama of landfill area taken from Airport Auto Wrecking, Too. The landfill is the brush covered area.
1-7	N	01/28/03	1445	ML	Panorama of the landfill from the edge of the landfill. Taken from the adjacent property.
1-8	NE	01/28/03	1445	ML	Panorama of the landfill from the edge of the landfill. Taken from the adjacent property.
1-9	NE	01/28/03	1445	ML	Panorama of the landfill from the edge of the landfill. Taken from the adjacent property.
1-10	E	01/28/03	1445	ML	Panorama of the landfill from the edge of the landfill. Taken from the adjacent property.
1-11	N	01/28/03	1449	ML	Panorama of the landfill from the edge of the landfill. Taken from the adjacent property.
1-12	NE	01/28/03	1449	ML	Panorama of the landfill from the edge of the landfill. Taken from the adjacent property.
1-13	NE	01/28/03	1449	ML	Panorama of the landfill from the edge of the landfill. Taken from the adjacent property.
1-14	E	01/28/03	1449	ML	Panorama of the landfill from the edge of the landfill. Taken from the adjacent property.
1-15	SE	01/28/03	1453	ML	Pond from south end of landfill at the location near the upstream portion of the channel that flows over the top of the landfill.
1-16	N	01/28/03	1453	ML	Pond from south end of landfill at the location near the upstream portion of the channel that flows over the top of the landfill.
1-17	N	01/28/03	1506	ML	Depression that apparently serves as overland flow channel when flood water flows over the landfill.
1-18	SE	01/28/03	1524	ML	Gorst Creek drainage and the northwest face of the landfill in the background. Taken from Highway 3 SW.
1-19	S	01/28/03	1527	ML	Gorst Creek at the downstream rip rap catchment berm.
1-20	SE	01/28/03	1530	ML	Gorst Creek flowing through the upstream rip rap catchment berm (the berm was largely eroded during the 2001 flood event), and the west face of the landfill (background). Note the landfill debris that is exposed in the face of the slope.

**PHOTOGRAPH IDENTIFICATION SHEET**

Camera Serial No.: 897924

TDD No: 02-10-0005

Lens Type: Pentax Zoom 90-WR 35 mm

Site Name: Gorst Creek - Bremerton Auto Wrecking Landfill

Photo No.	Dir.	Date	Time	By	Description
1-21	NE	01/28/03	1535	ML	Panorama of the west face of the landfill from the upstream rip rap catchment berm.
1-22	E	01/28/03	1535	ML	Panorama of the west face of the landfill from the upstream rip rap catchment berm.
1-23	E	01/28/03	1535	ML	Panorama of the west face of the landfill from the upstream rip rap catchment berm.
1-24	SE	01/28/03	1535	ML	Panorama of the west face of the landfill from the upstream rip rap catchment berm.
1-25	SE	01/28/03	1541	ML	Spring issuing from the west face of the landfill.

## Key:

E = East.  
ML = Mark Longtine.  
N = North.  
S = South.  
W = West.

Table 2-2

**SEDIMENT SAMPLES ANALYTICAL RESULTS SUMMARY  
GORST CREEK - BREMERTON AUTO WRECKING LANDFILL  
PRELIMINARY ASSESSMENT  
PORT ORCHARD, WASHINGTON**

Sample ID	GL-SED-01	GL-SED-02	GL-SED-03	GL-SED-04
Sample Date	1/10/2000	1/11/2000	1/11/2000	1/11/2000
Description	Background	Composite		
Pesticides/PCBs (mg/kg)				
4,4'-DDT	0.0043 U	0.012 J	0.0041 U	0.0041 U
SVOCs (mg/kg)				
4-Methylphenol	0.43 U	0.017 J	0.4 U	0.4 U
Benzo(a)anthracene	0.43 U	0.045 J	0.4 U	0.4 U
Benzo(a)anthracene	0.43 U	0.045 J	0.4 U	0.4 U
Benzo(b)fluoranthene	0.43	0.058 J	0.4 U	0.4 U
Benzo(k)fluoranthene	0.43	0.042 J	0.4 U	0.4 U
Butylbenzylphthalate	0.43 U	0.095 J	0.4 U	0.4 U
Chrysene	0.43 U	0.073 J	0.4 U	0.4 U
Di-n-butylphthalate	0.43 U	0.03 J	0.4 U	0.4 U
Di-n-octylphthalate	0.43 U	0.027 J	0.4 U	0.4 U
Fluoranthene	0.43 U	0.097 J	0.4 U	0.4 U
Indeno(1,2,3-cd)pyrene	0.43 U	0.045 J	0.4 U	0.4 U
Pentachlorophenol	1.1 U	0.036 J	1 U	1 U
Phenanthrene	0.43 U	0.06 J	0.4 U	0.4 U
Pyrene	0.43 U	0.097 J	0.4 U	0.4 U
TAL Metals (mg/kg)				
Antimony	3.4 U	7.6	3.2 U	3.2 U
Arsenic	2	3.5	27.7	2.1
Chromium	35.7	30.5	17.3	30.3
Copper	11.3	159	12.7	19.7
Lead	4.2	113	16.6	12.4
Nickel	54	53.2	23.1	32.1
Zinc	45.4	108	76.4	97.3

Source: Hart Crowser 2000.

Note: Bold type indicates the sample result is above the detection limit.

**Key:**

ID = Identification.  
 J = Estimated value.  
 mg/kg = Milligrams per kilogram.  
 PCBs = Polychlorinated biphenyl.  
 SVOC = Semivolatile organic compound.  
 TAL = Target Analyte List.  
 U = Not detected at indicated detection limit.



Table 2-1

**SURFACE SOIL SAMPLES ANALYTICAL RESULTS SUMMARY**  
**GORST CREEK - BREMERTON AUTO WRECKING LANDFILL PRELIMINARY ASSESSMENT**  
**PORT ORCHARD, WASHINGTON**

Sample ID	GL-SS-01	GL-SS-02	GL-SS-03	GL-SS-04	GL-SS-05	GL-SS-06	GL-SS-07	GL-SS-08
Sample Date	1/10/2000	1/10/2000	1/10/2000	1/10/2000	1/10/2000	1/10/2000	1/10/2000	1/10/2000
Description	Background	Discrete Grab			Composite			Field Duplicate
TAL Metals (mg/kg)								
Antimony	3.6 U	3.0 U	5.9	3.1 U	4.7	3.2 U	3.3 U	3.2 U
Arsenic	2.3	5.2	1.7	1.2	0.91	1.6	1.6	1.4
Cadmium	0.36 U	1	0.83	0.31 U	0.3 U	0.32 U	0.33 U	0.32 U
Chromium	23	28	30.3	25.2	22.4	19	27.9	19.8
Copper	12.5	34.1	64.8	30.7	22.3	10	13	11.7
Lead	10	235	57.9	32.8	17.8	12.7	16.3	10.6
Mercury	0.045 U	0.1	0.25	0.094	0.046	0.046 U	0.047 U	0.049 U
Nickel	32.1	35.7	44	28.5	34.3	24.4	35.4	32.1
Zinc	31.5	178	235	105	77.4	27.7	44.5	40.3

Source: Hart Crowser 2000.

Note: Bold type indicates the sample results is above the instrument detection limit.

## Key:

ID = Identification.

J = Estimated value.

mg/kg = Milligrams per kilogram.

PCBs = Polychlorinated biphenyls.

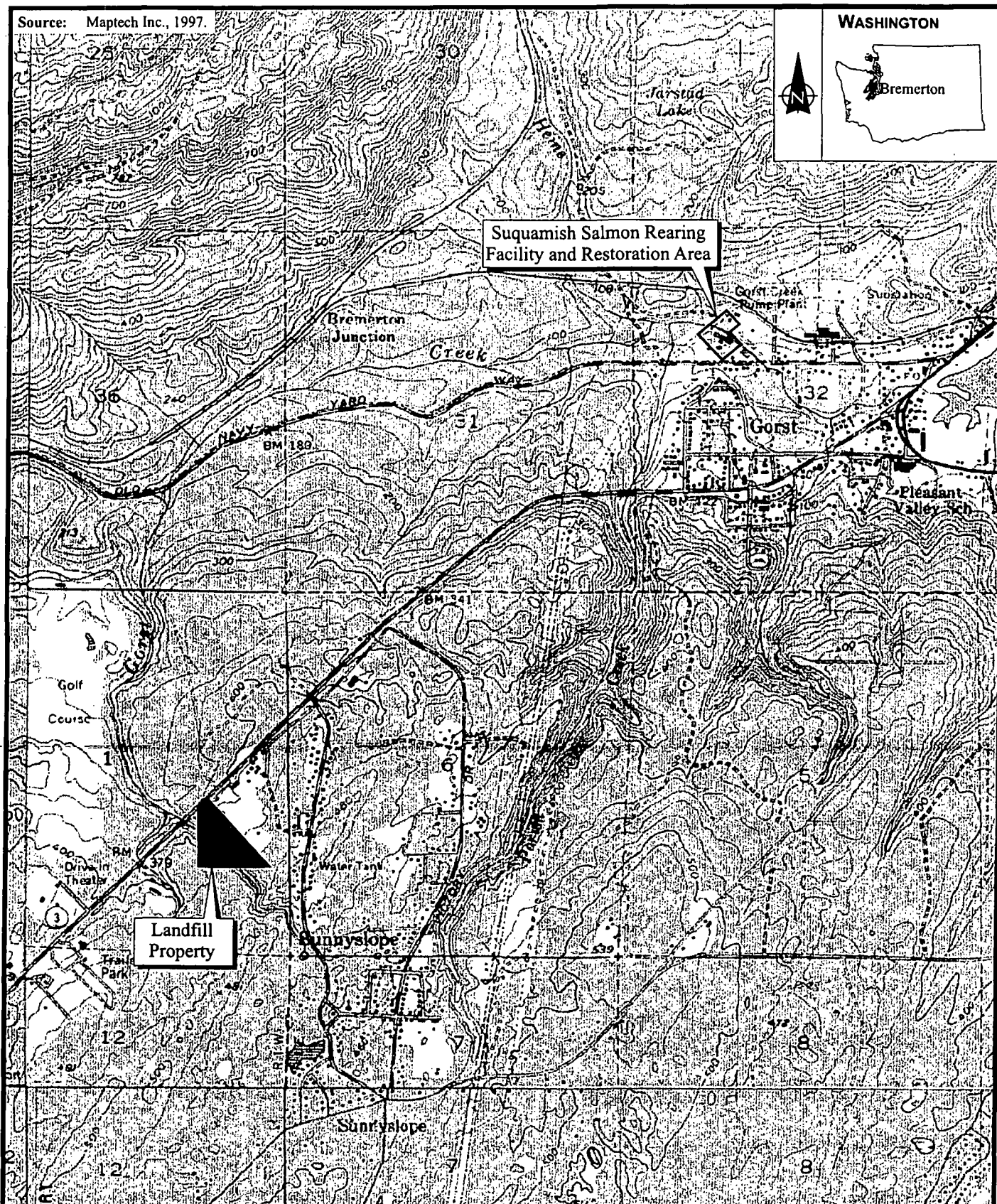
SVOC = Semivolatile organic compound.

TAL = Target Analyte List.

U = Not detected at indicated detection limit.

Source: Maptech Inc., 1997.

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**GORST CREEK-BREMERTON  
AUTO WRECKING LANDFILL  
PRELIMINARY ASSESSMENT  
Port Orchard, Washington**

0 .25 .5  
Approximate Scale in Miles

Figure 2-1

**SITE VICINITY MAP**

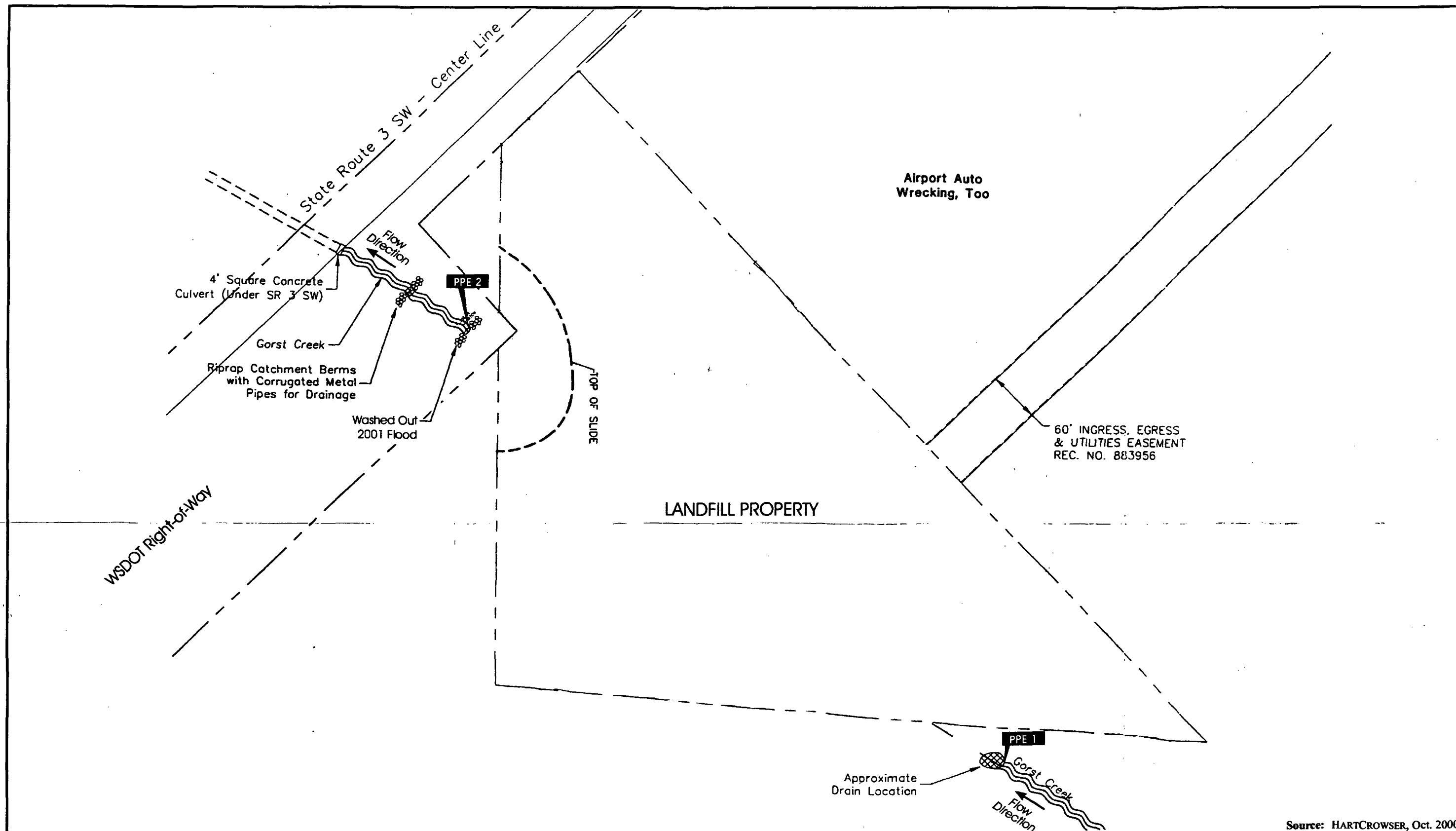
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3-26-03

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Source: HARTCROWSER, Oct. 2000.



0 100 200  
Approximate Scale in Feet

GORST CREEK-BREMERTON  
AUTO WRECKING LANDFILL  
PRELIMINARY ASSESSMENT  
Port Orchard, Washington

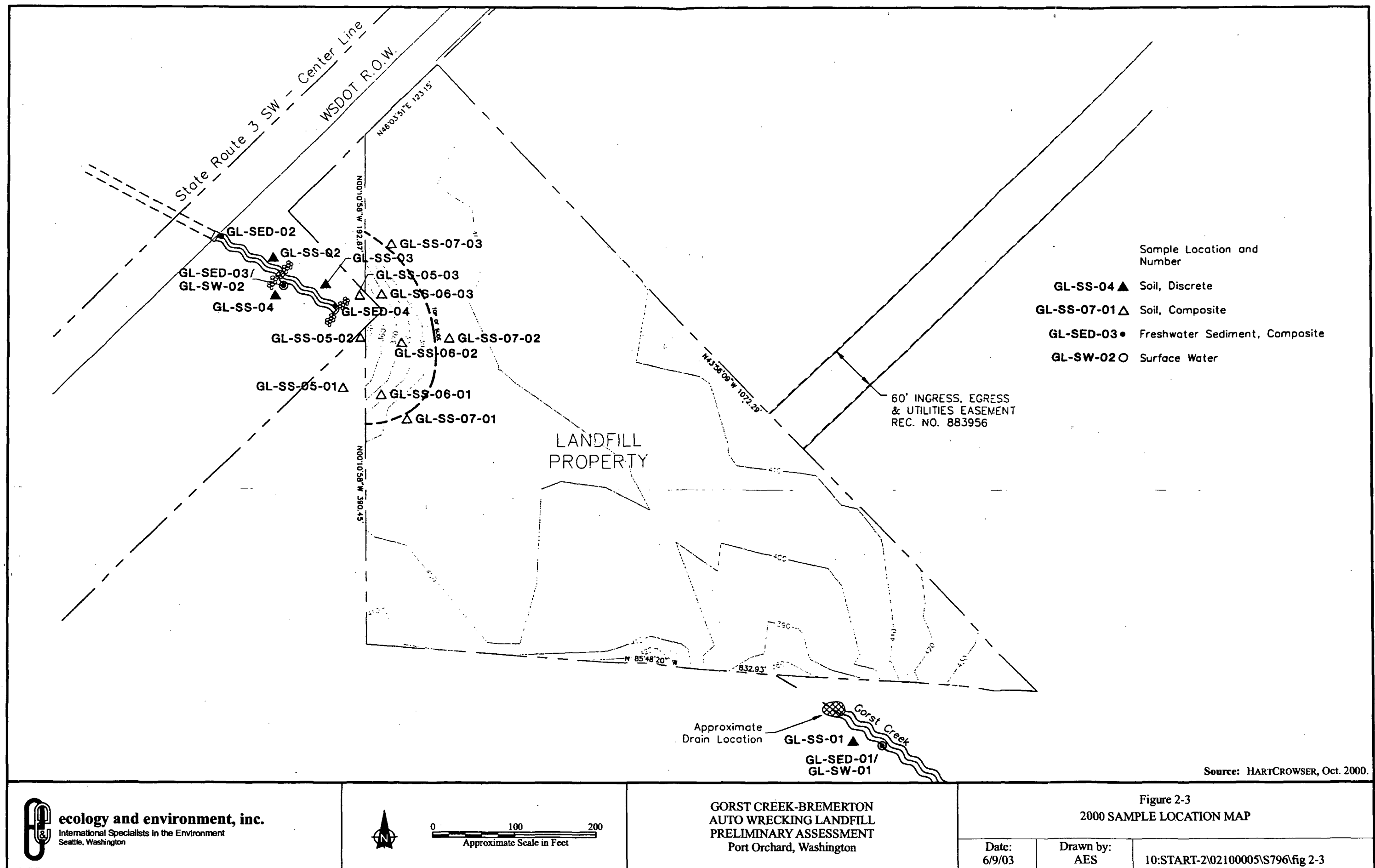
Figure 2-2  
SITE MAP

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3/26/03

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### **3. MIGRATION/EXPOSURE PATHWAYS AND TARGETS**

The following sections describe migration/exposure pathways and potential targets within the site's range of influence (Figures 3-1 and 3-2).

#### **3.1 GROUNDWATER MIGRATION PATHWAY**

The aquifers associated with the site are defined in two areas, the Gorst Area and the Anderson Creek Watershed. In the Gorst Area four aquifers have been described; the Twin Lakes Aquifer, the Gorst Creek Valley Aquifer, the Upland Aquifer, and the Sea Level Aquifer. In the Anderson Creek Watershed area five aquifers have been described; the Upland Aquifer, the Sea Level Aquifer, the Shallow Artesian Aquifer, the Deep Artesian Aquifer, and the Lower Deep Artesian Aquifer. Not all of these aquifers are used for municipal drinking water purposes but all are available to be used as drinking water and therefore are included in this report. (AGI 1996)

A wellhead protection area report was prepared by AGI Technologies in 1996 for the City of Bremerton Public Works and Utilities Department. This report provided information regarding the aquifers associated with the Gorst Creek - Bremerton Auto Wrecking Landfill. Information regarding depth to the aquifer and direction of water flow was not provided for all aquifers. When the information was provided in the AGI report, it was included in this PA report.

The Gorst Area Basin is underlain by three geologic units: Vashon Till, Vashon Recessional Outwash, and Tertiary Bedrock. The Tertiary Bedrock occurs beneath Gold Mountain north of Gorst Creek Basin and Twin Lakes. The northern tributaries to Gorst Creek Basin and the Union River drain this area. Vashon Till underlies the upland south of Gorst Creek Basin, including the Town of Sunnyslope and the headwater of Gorst Creek Basin and its southern tributaries. The Vashon Recessional Outwash occurs along the Gorst Creek Basin Valley and on the Union River - Gorst Creek Basin divide near Twin Lakes. Small exposures of the older Colvos Sand Occur along Parish Creek and adjacent tributaries. (AGI 1996)

The four effective aquifers are large tabular-shaped or irregularly-shaped, discontinuous bodies. The upper surface is defined as the water table in partially saturated sand or gravel. In most cases, they terminate against silt, till, or silty sand. The boundary is known because of a lack of data in many



instances. Where the vertical separation between effective aquifers is slight, ground water leakage from the higher to the lower aquifer can be expected. The effective aquifers are described below:

- **Twin Lakes Aquifer:** The Twin Lakes Aquifer is the largest effective aquifer in the Gorst Creek Basin. The surface expression is the Vashon Recessional Outwash. The Twin Lakes Aquifer is divided into an eastern and western portion by a silt-cored paleo-ridge. Its lower boundary appears to be bedrock along the base of Gold Mountain and the massive silt of the silt sequence. Its upper boundary is a water table, and it generally behaves as an unconfined aquifer. Occasional silt lenses within these units may cause it to locally behave as a confined aquifer. Bremerton City Production Wells 15, 17, 18, 19, and 20 are completed in this aquifer which serves approximately 10,000 people.
- **Gorst Creek Valley Aquifer:** The Gorst Creek Valley Aquifer consists of sand and gravel units and Domsea Wells in the lower Gorst Creek Basin Valley. It is bounded by the bedrock of Fold and green Mountains to the north and by the massive silt of the silt sequence in the south. It appears to be separated from the Twin Lakes aquifer by silty sand. This separation is poorly defined by permeability, but water chemistry and aquifer test data confirm its presence. Its upper boundary is a water table, and it behaves as an unconfined aquifer in many places. It may demonstrate confined behavior in areas with silt lenses. The Gorst Creek Production well is completed in this aquifer which serves approximately 2,000 people.
- **Upland Aquifer:** The Upland Aquifer consists of the sand and gravel units occurring between elevations of 250 and 400 feet above sea level. Locally, these units are separated by either till or silt to form two distinct aquifers. It is everywhere confined by the Vashon Till and appears to become thicker to the east. It is exposed on the upper reaches of the tributaries to Gorst Creek Basin and underlies the Sunnyslope Upland. It discharges into the Twin Lakes Aquifer along the southern margin of the Twin Lakes Divide. None of the Bremerton City production wells are completed in this aquifer.
- **Sea Level Aquifer:** The Sea Level Aquifer consists of sand and gravel in units that occur between elevations from sea level to more than 200 feet below sea level. Locally these units are separated by till and are everywhere confined by massive silt. The aquifer is bounded on the north by the bedrock of Gold Mountain and the coarse-grained sediments in the deeper portions of the Gorst Creek Valley and Twin Lakes Aquifers. It may be equivalent to the sea level aquifer encountered in the wells in the Anderson Creek Watershed although its extent to the south, east, and west is unknown. It discharges to the Twin Lakes Aquifer through the buried valley along the upper reaches of Gorst Creek Basin and to the deeper portions of the Gorst Creek Valley Aquifer. One City of Bremerton drinking water well is completed in this aquifer, which serves approximately 2,000 people. (AGI 1996)

The surface geology of the Anderson Creek Watershed area is mantled with Vashon Till overlying the Colvos Sand and Kitsap Formation which are exposed in the valleys and in the bluff along

Sinclair Inlet. The Colvos Sand includes the Vashon Advance Outwash and a thick basal silt (Lawton Clay), and the underlying Kitsap Formation consists of silty sediments with scattered sand units. The Kitsap Formation is exposed in lower portions of the Anderson Creek Valley around the Bremerton City well field, and the Colvos Sand is exposed higher on the flanking hill slopes. Vashon Till caps the upland portion of the watershed area. (AGI 1996)

The aquifers in the Anderson Creek Watershed are described as follows:

- **Upland Aquifer:** The Upland Aquifer occurs south of Sinclair Inlet at elevations above 100 feet. It is highly irregular in thickness and varies from less than 50 feet to over 350 feet. It appears to consist of sand- and gravel- filled paleo-valleys connected by sheets of sand and gravel. It is utilized by numerous domestic wells, no City of Bremerton production wells are located within this aquifer..
- **Sea Level Aquifer:** The Sea Level Aquifer occurs south of Sinclair Inlet at elevations between plus 100 feet and minus 250 feet. It varies in thickness from 75 feet to as much as 300 feet. In some places, it may be hydraulically connected with the overlying Upland Aquifer. The Sea Level Aquifer is utilized only by domestic wells, and one City of Bremerton Production Well (see Sea Level Aquifer description above).
- **Shallow Artesian Aquifer:** The Shallow Artesian Aquifer occurs at elevations of 100 to 250 feet below sea level. The aquifer abruptly terminates against till and silt and probably has a channel shape elongated to the south. The Shallow Artesian Aquifer is 75 to 200 feet thick and underlies the Anderson Creek Well Field where Bremerton City monitoring wells 1, 2R, N and Productions Wells 2 and 3 are completed, which serves approximately 4,000 people.
- **Deep Artesian Aquifer:** The Deep Artesian Aquifer occurs between elevations of 400 feet and 600 feet below sea level. Similar to other aquifers, it terminates abruptly against finer-grained sediments and may be channel-shaped. It is at least 200 feet thick and has a transmissivity around 65,000 gallons per day per foot. It may be connected hydraulically with the underlying Lower Deep Artesian Aquifer. Bremerton City wells 7 and 8 are completed in this aquifer, which serves approximately 4,000 people.
- **Lower Deep Artesian Aquifer:** The Lower Deep Artesian Aquifer occurs at depths greater than 650 feet below sea level. The aquifer is at least 150 feet thick and may be hydraulically connected with the overlying Deep Artesian Aquifer. There are no City of Bremerton production wells located in this aquifer. (AGI 1996)

The total number of persons served by municipal drinking water wells is 22,000 (Cahall 2003b). The nearest well is located approximately ¼ mile from the site (Ecology various dates). Four hundred fifty-five domestic wells are known to exist within a 4-mile radius of the site (Ecology various dates). The START-2 estimates approximately 1,219 people are served by these wells, based on the average number of persons per household for Kitsap County (DOC 2001). One privately owned community well

One City of Bremerton Water Resource Division monitoring well (BR-11) is located approximately 0.15 mile northeast of the site. The well was installed in 1992 to a depth of 74 feet. The well was sampled on March 26, 1997, seven days after the first flood event. Cadmium was detected at 42.7 micrograms per liter ( $\mu\text{g/L}$ ), copper was detected at 3.0  $\mu\text{g/L}$ , and zinc was detected at 75  $\mu\text{g/L}$ . (Cahall 2003a)

The site, and all of the municipal wells are located within a wellhead protection area. The site is not located within 1 mile of any Safe Drinking Water Act sole source aquifer (EPA 2003). Groundwater is not reported to be used for irrigation of commercial food or commercial forage crops, commercial livestock watering, as an ingredient in commercial food preparation, as a supply for commercial aquaculture, or as a supply for a major or designated water recreation area (Ecology various dates).

### **3.2 SURFACE WATER MIGRATION PATHWAY**

The elevation of the Gorst Creek - Bremerton Auto Wrecking Landfill ranges from approximately 350 to 420 feet above mean sea level (Hart Crowser 2000). The site is mostly flat up to the property boundaries of the landfill. The edges of the landfill slope towards Gorst Creek at an estimated slope of 30 to 45 percent. The START-2 has identified two probable points of entry (PPEs) within the 15-mile surface water migration pathway TDL (Figures 2-2 and 3-2). PPE 1 is located the southeast corner of the property in Gorst Creek. Gorst Creek flows under the Gorst Creek - Bremerton Auto Wrecking Landfill for approximately 0.13 mile to PPE 2. PPE 2 is located on the northwest side of the landfill in Gorst Creek. From PPE 2, the creek flows for 3.72 miles to Puget Sound. The TDL continues within Puget Sound for the remainder of the 15-mile TDL. The START-2 estimates the flow of Gorst Creek to be approximately 10 cubic feet per second.

The mean annual precipitation in Bremerton, Washington, which is located is approximately 4 miles northeast of the site, is 51.36 inches (WRCC 2003). The 2-year 24-hour rainfall event for the site is 2.25 inches (NOAA 1973).

The START-2 estimates that approximately 7 acres of upland drainage exist at the site.

Surface soils in the area consist of Alderwood very gravelly sandy loam, which is moderately deep, moderately well drained soil in on upland, and which was formed in glacial till. Typically, the surface of this soil is covered by a thin mat of undecomposed needles and wood fragments. The subsurface layer is brown, very gravelly sandy loam  $\frac{1}{2}$  inch thick. The subsoil is brown very gravelly loam about 21 inches thick. The substratum to a depth of 60 inches or more is grayish brown gravelly sandy loam that is weakly-silica-cemented in the upper part. Depth to the silica-cemented hardpan ranges

from 20 to 40 inches. Permeability of this Alderwood soil is moderately rapid above the hardpan and very slow in the pan. The available water capacity is low. The effective rooting depth ranges from 20 to 40 inches. Matting of roots directly above the hardpan is common. Runoff is slow, and the hazard of water erosion is slight. The Alderwood soil has a perched water table at a depth of 2.5 to 3 feet for short periods during the rainy season in winter and spring. (USDA 1980)

Surface soils in the area also consist of Dystric Xerorthents, which are deep, moderately well drained to somewhat excessively drained soils located on sidewalls of river valleys and entrenched streams. These soils formed mainly in glacial till, but some formed in sandy and gravelly outwash. Typically this soil has a mat of undecomposed needles and wood fragments over a surface layer of dark yellowish brown very gravelly sandy loam about 10 inches thick. The upper part of the underlying material is dark brown, brown, and dark yellowish brown very gravelly sandy loam and very gravelly loamy sand. The permeability of these soil is moderate to rapid. Runoff is medium to very rapid. These soils are mainly in tree-covered slump areas. The hazard of erosion is high. (USDA 1980)

The START-2 assumes the site lies within a 10-year floodplain because the site has flooded two times (in 1997 and 2001) within the past 6 years. No sources at the site are contained for any flood event. During a flood event, water from Gorst Creek backs-up at PPE 1 and flows in a northwest direction over the landfill for approximately 0.13 mile, then drops over the northwest side of the landfill into Gorst Creek (Appendix A; Photograph 1-17).

There are no surface water drinking water intakes located within the 15-mile TDL. Surface water is not reported to be used in the irrigation of 5 or more acres of commercial food crops or commercial forage crops, watering of commercial livestock, as an ingredient in commercial food preparation, or as a major or designated water recreation area.

One tribal fishery and hatchery is located within the 15-mile TDL. The fishery and hatchery is located near the mouth of Gorst Creek into Sinclair Inlet approximately 3 miles downstream of the site and is operated by the Suquamish Tribe. Fish catch data for 1998 indicates a total of 76,707 pounds of salmon were caught in Area 10, which is further described as the west side of Bainbridge Island (Suquamish 2003). No fishing occurs in Gorst Creek (Huff 2003b).

Three Federal-listed threatened species are documented to exist within the 15-Mile TDL. The Chum salmon (*Oncorhynchus keta*) and Chinook salmon (*Oncorhynchus tshawytscha*), Federal-listed threatened species are located in Gorst Creek from the headwaters of the creek down to its mouth in Sinclair Inlet (Huff 2003a; WDFW 2002). There are bald eagles (*Haliaeetus leucocephalus*), a Federal-

listed threatened species, nesting within a 4-mile radius of the site. The START-2 assumes the eagles are consuming fish that are located within the surface water TDL (WDFW 2002).

There are 2.6 miles of wetland frontage occur along the 15-mile TDL (USFWS 1997a, 1997b, 1997c, 1997d, 1997e, 1997f, 1997g, 1997h). The nearest wetland to the site along the surface water TDL is located on Sinclair Inlet approximately 3 miles downstream of the site. All wetland frontage occurs on the waters of Puget Sound.

### **3.3 SOIL EXPOSURE PATHWAY**

Access to the Gorst Creek - Bremerton Auto Wrecking Landfill is restricted to an easement through the Airport Auto Wrecking, Too facility. There are no residences within 200 feet of a the landfill. There are no workers on-site and within 200 feet of a potential source. The population within 1 mile of the site includes 729 people (EPA 2003). There are no known schools or daycare facilities within 200 feet of a potential source. There are no terrestrially sensitive environments located on a potential source (WDFW 200).

### **3.4 AIR MIGRATION PATHWAY**

There are 6,434 permanent residents within a 4-mile radius of the site (EPA 2003). There are approximately 10 workers at the adjacent facility, Airport Auto Wrecking, Too. There are bald eagles (*Haliaeetus leucocephalus*), a Federal-listed threatened species, nesting within a 4-mile radius of the site (WDFW 2002). There is no commercial agriculture or silviculture within 0.5 mile of the site. There are 633.7 acres of designated wetlands within 4 miles of the site (EPA). There are no other resources known to exist within a 4-mile radius of the site. Wetland acreage and population within 4 miles of the site are presented in Table 3-2.

**Table 3-1**

**GROUNDWATER DRINKING WATER POPULATION WITHIN A 4-MILE RADIUS  
GORST CREEK - BREMERTON AUTO WRECKING LANDFILL  
PRELIMINARY ASSESSMENT  
PORT ORCHARD, WASHINGTON**

<b>Distance (Miles)</b>	<b>Wells</b>	<b>Population</b>
0 - ¼	2 (Domestic)	5
¼ - ½	20 (Domestic)	54
	1 (Municipal)	2,000
½ - 1	37 (Domestic)	99
	3 (Municipal)	6,000
1 - 2	46 (Domestic)	123
	3 (Municipal)	6,000
2 - 3	108 (Domestic)	289
	4 (Municipal)	8,000
	1 (Community)	7
3 - 4	242 (Domestic)	649
<b>Total</b>	<b>466</b>	<b>23,226</b>

Source: Cahall 2003b; DOC 2001; Ecology various dates

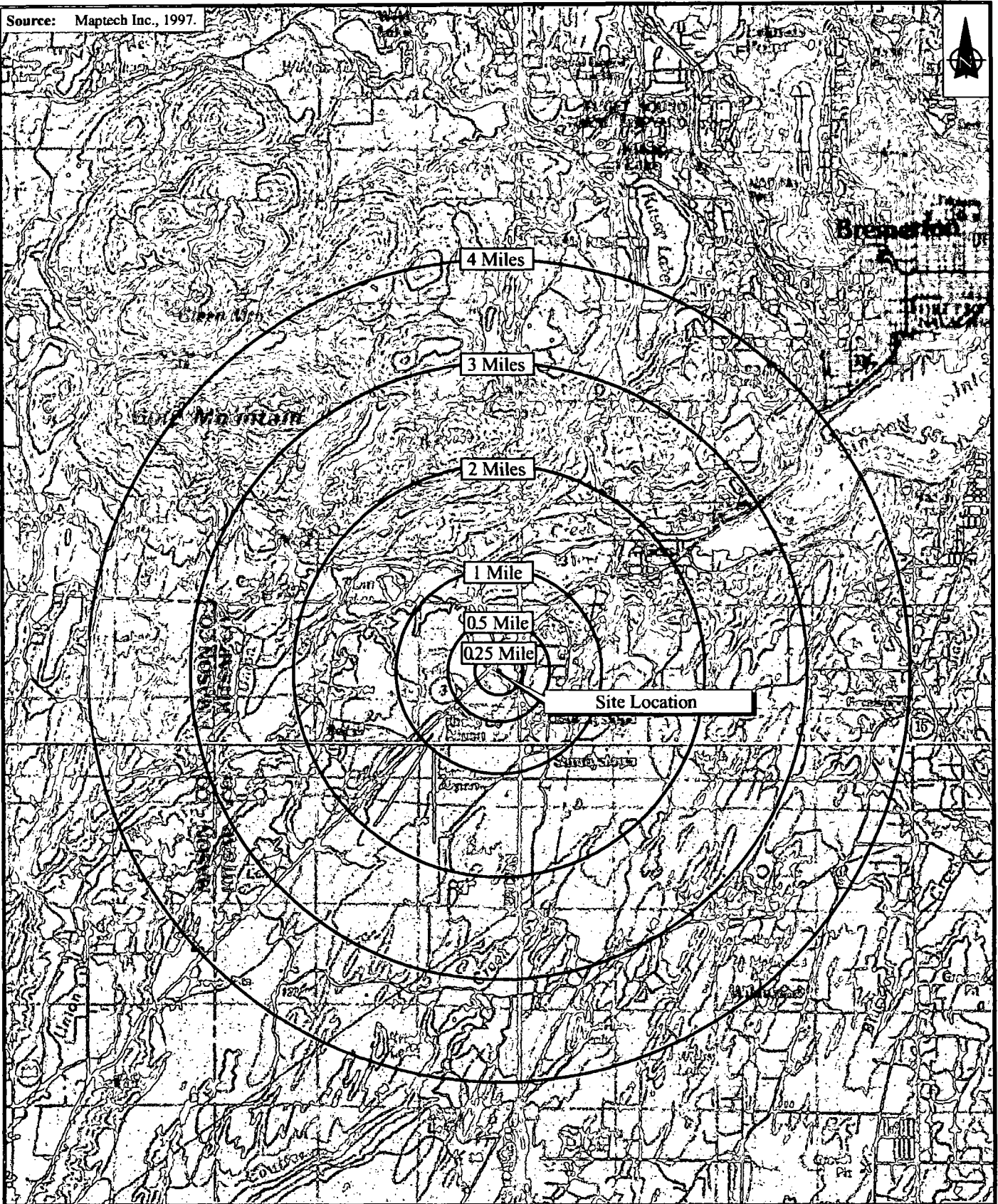
**Table 3-2**

**POPULATION AND WETLANDS WITHIN A 4-MILE RADIUS  
GORST CREEK - BREMERTON AUTO WRECKING LANDFILL  
PRELIMINARY ASSESSMENT  
PORT ORCHARD, WASHINGTON**

<b>Distance Ring (Miles)</b>	<b>Population</b>	<b>Wetlands (Acreage)</b>
On site	0	0
0-¼	9	0
¼-½	86	0.2
½-1	634	12.2
1-2	1,111	84.4
2-3	1,962	215.7
3-4	2,632	321.3
<b>Total</b>	<b>6,434</b>	<b>633.7</b>

Source: EPA 2003.

Source: Maptech Inc., 1997.



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**GORST CREEK-BREMERTON  
AUTO WRECKING LANDFILL  
PRELIMINARY ASSESSMENT  
Port Orchard, Washington**

0 1 2  
Approximate Scale in Miles

Figure 3-1

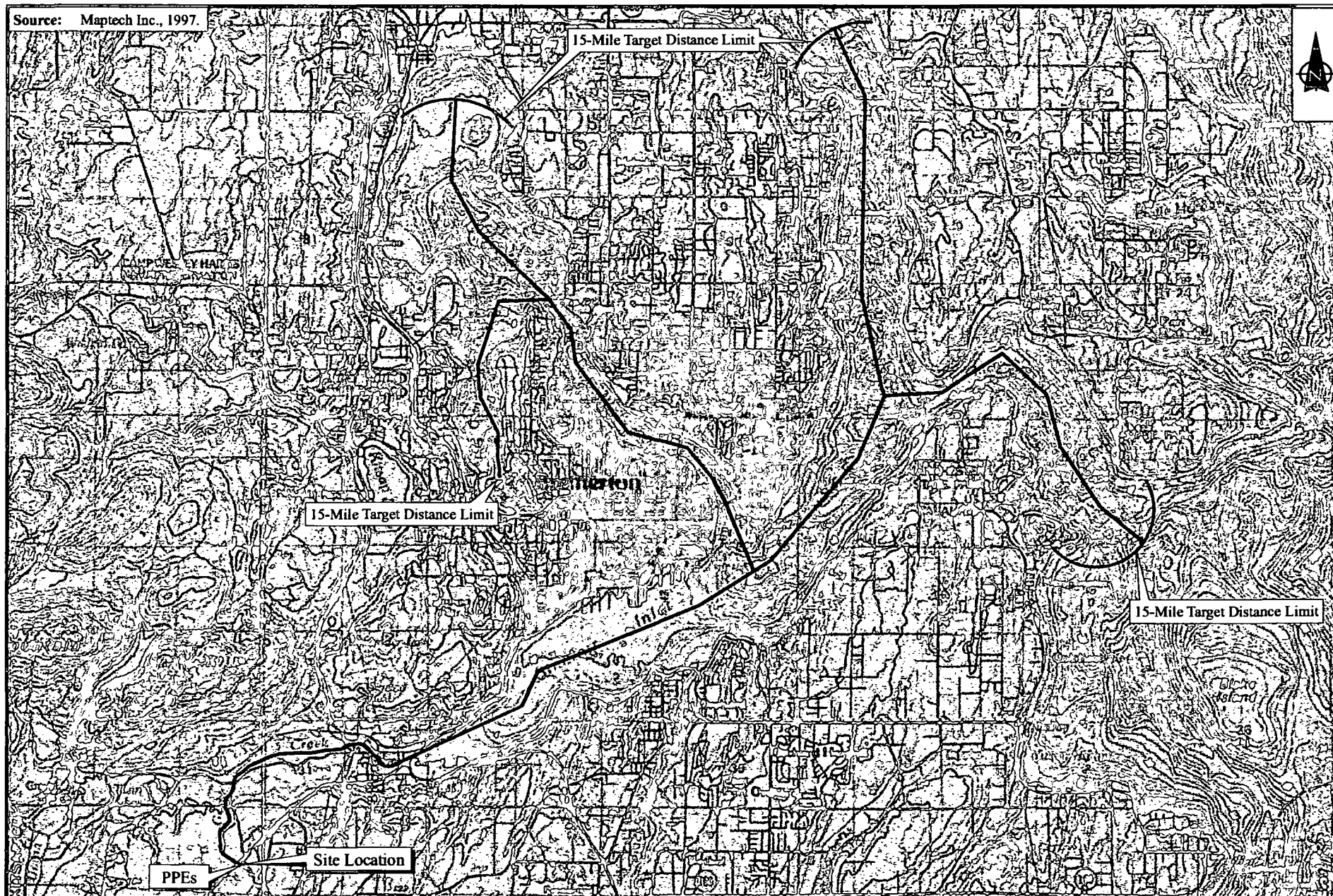
4-MILE MAP

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AUTO WRECKING LANDFILL  
PRELIMINARY ASSESSMENT  
Port Orchard, Washington**

0 0.789 1.578  
Approximate Scale in Miles

**Figure 3-2  
15-MILE MAP**

Date:  
4/22/03

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AES

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#### **4. CONCLUSIONS AND RECOMMENDATIONS**

The Gorst Creek - Bremerton Auto Wrecking Landfill is located over the Gorst Creek ravine. The Gorst Creek flows under the landfill through a culvert that was constructed in 1968. The START-2 identified two PPEs at the landfill. PPE 1 is located at the southeast corner of the property where Gorst Creek enters the culvert and flows under the landfill. PPE 2 is located at the northwest corner of the property where Gorst Creek exits the culvert. Gorst Creek contains the Federal-listed threatened species Chum salmon and Chinook salmon. Additionally, the bald eagle, a Federal-listed threatened species, are nesting within 4-miles of the site and are assumed to consume the salmon within the 15-mile TDL.

Based on the results of the sampling conducted by Hart Crowser, pesticides/PCBs, SVOCs, and TAL metals were detected above instrument detection levels in on- and off-site surface soil samples. Additionally, sediment sample results indicated the presence of SVOCs and TAL metals in downstream sediment sample locations, indicating the site may be impacting Gorst Creek.

Based on an evaluation of the existing information and information obtained from START-2's site visit, further action under CERCLA or other authorities is recommended for the Gorst Creek - Bremerton Auto Wrecking Landfill.

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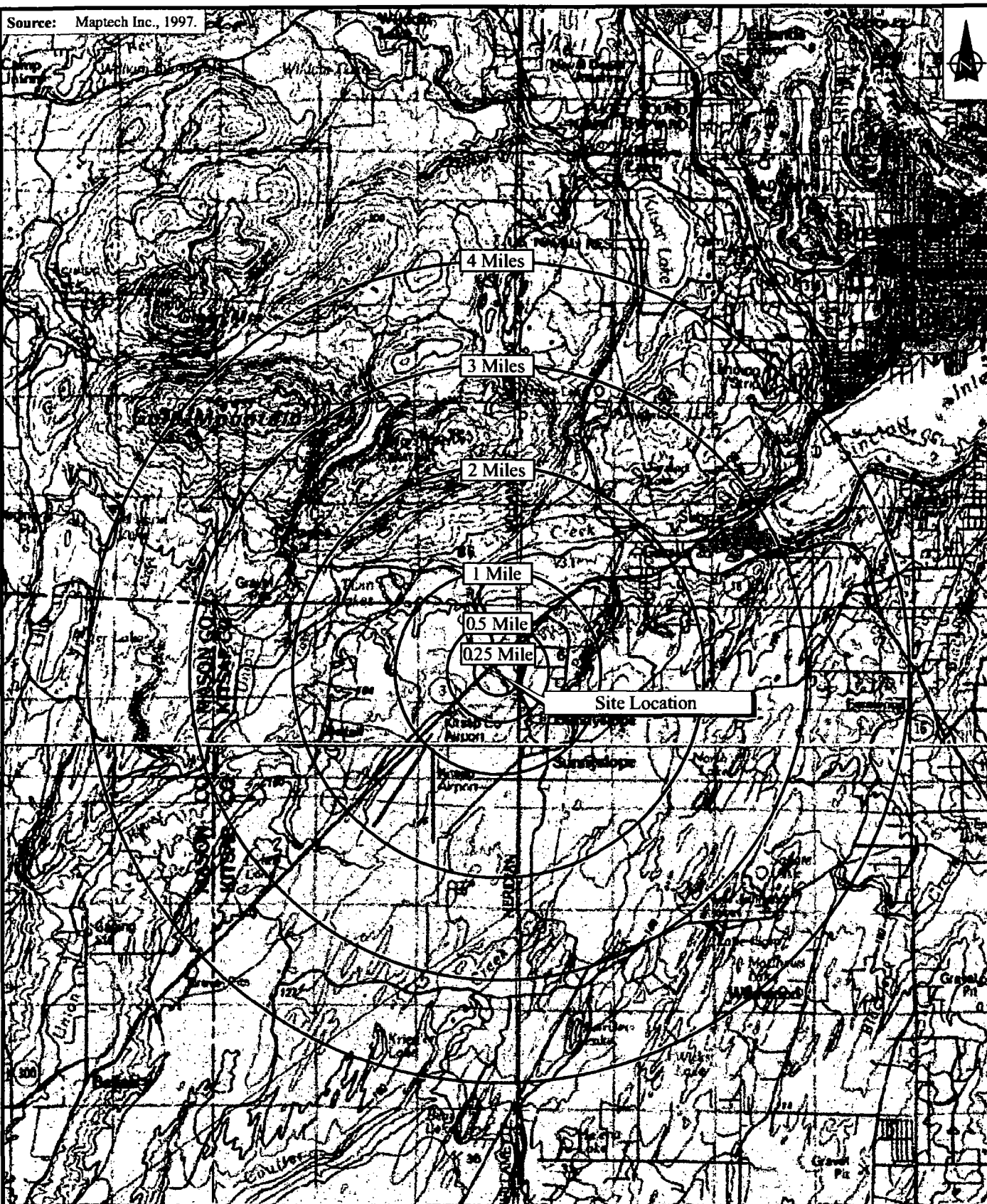
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PRELIMINARY ASSESSMENT  
Port Orchard, Washington**

0 1 2  
Approximate Scale in Miles

Figure 3-1

4-MILE MAP

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PRELIMINARY ASSESSMENT  
Port Orchard, Washington**

0 .789 1.578  
Approximate Scale in Miles

**Figure 3-2  
15-MILE MAP**

Date:  
4/22/03

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- AGI Technologies, October 11, 1996, *City of Bremerton Wellhead Protection Report*, prepared for the City of Bremerton Public Works and Utilities Department, Water Resources Division.
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———, 1997c, *Bremerton West, Washington Quadrangle*, 7.5 minute series National Wetland Inventory map.

———, 1997d, *Burley, Washington Quadrangle*, 7.5 minute series National Wetland Inventory map.

———, 1997e, *Duwamish Head, Washington Quadrangle*, 7.5 minute series National Wetland Inventory map.

———, 1997f, *Poulsbo, Washington Quadrangle*, 7.5 minute series National Wetland Inventory map.

———, 1997g, *Suquamish, Washington Quadrangle*, 7.5 minute series National Wetland Inventory map.

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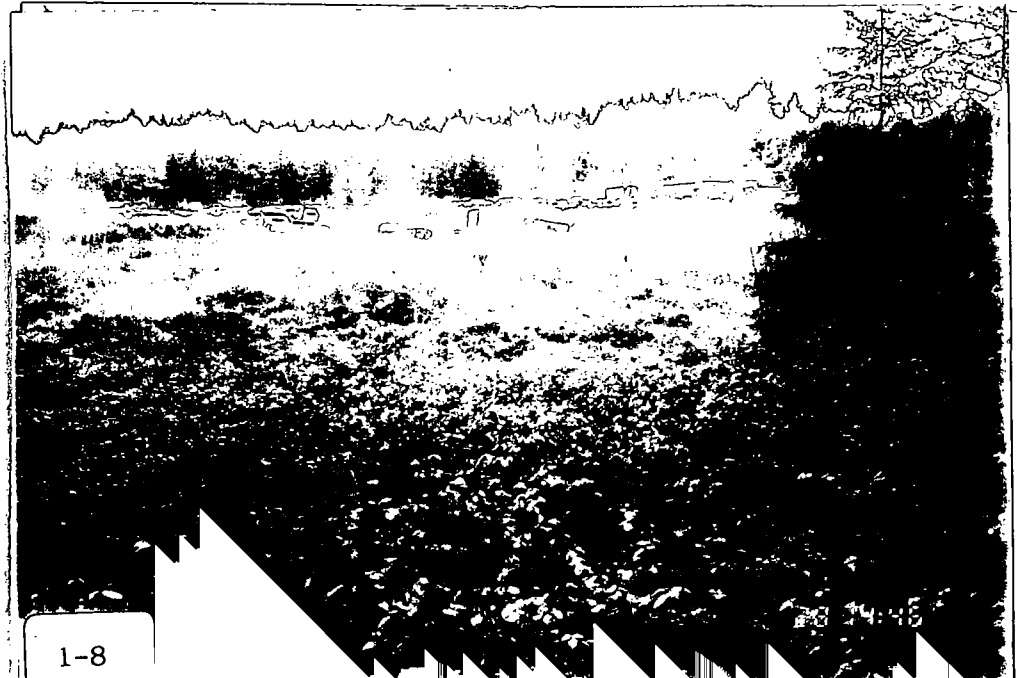
Washington State Department of Ecology (Ecology), various dates, water well reports, State of Washington.

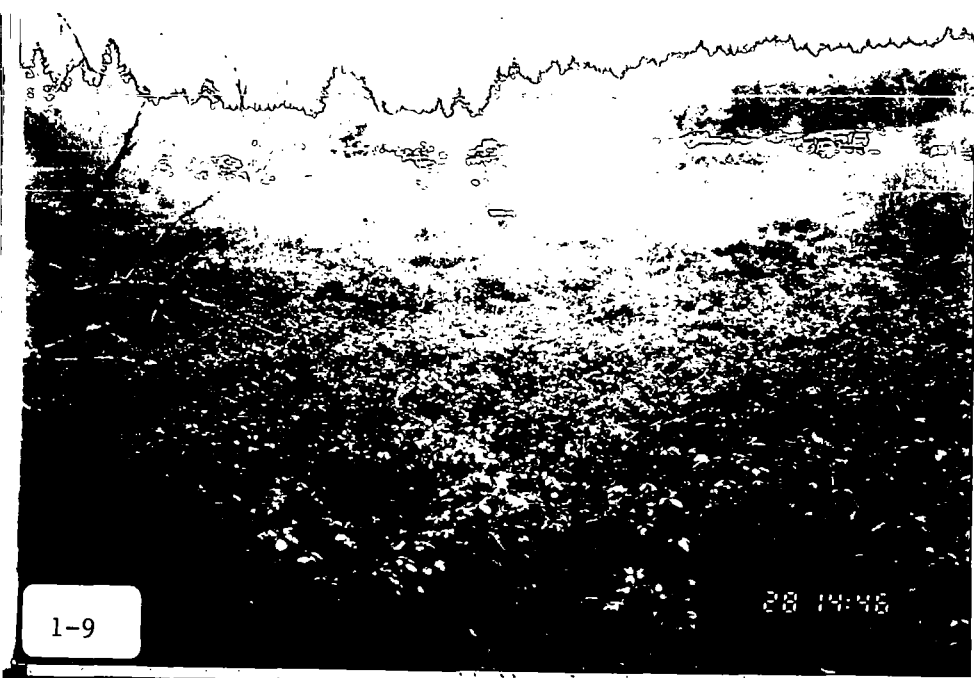
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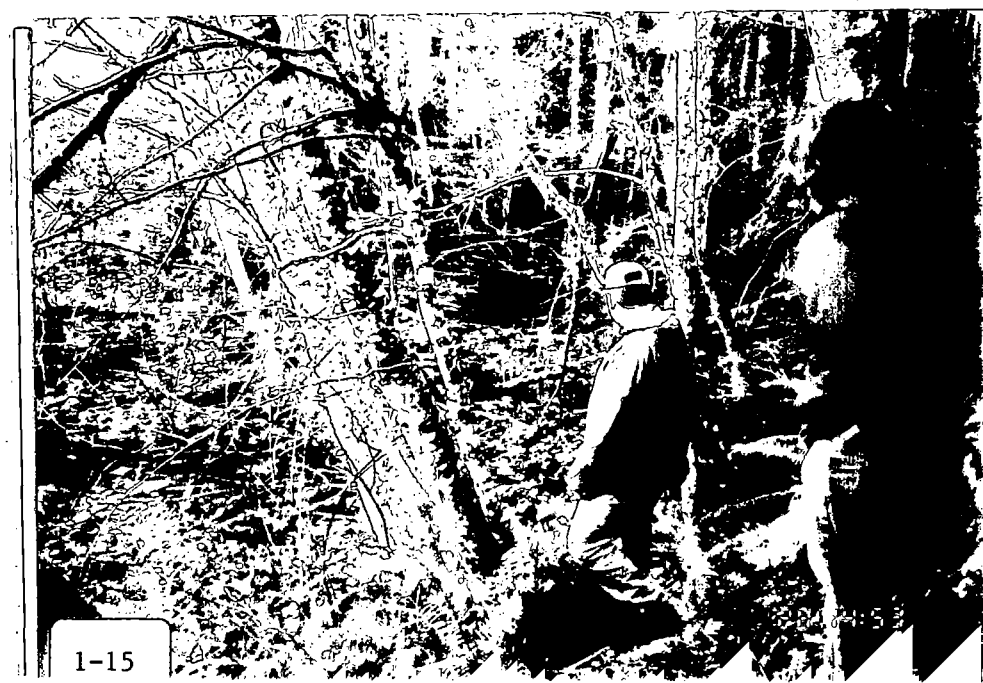
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**APPENDIX A**  
**PHOTOGRAPHIC DOCUMENTATION**











1-17



1-18

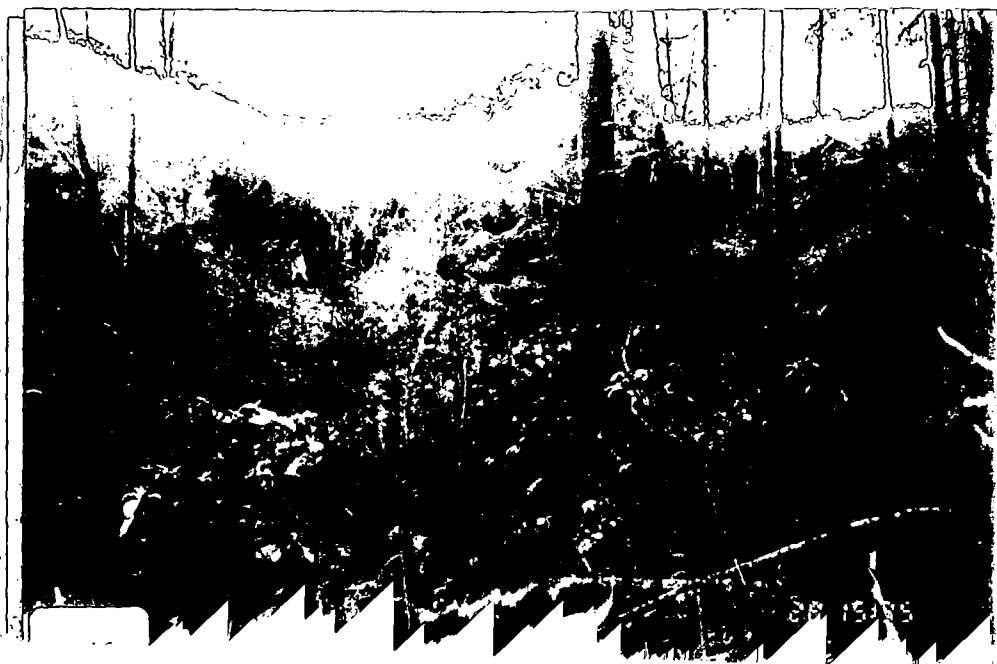


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